REMARKS

Claims 1, 9-11 and 18 were pending in the application. In the Office Action mailed June 8, 2010, claims 1, 9-11 and 18 are rejected. In the instant Amendment, claims 1 and 9 have been amended, claim 18 has been cancelled without prejudice, and new claims 19-20 have been added. Upon entry of the instant Amendment, claims 1, 9-11 and 19-20 will be pending in the application.

Claims 1 and 9 have been amended to delete the recitations of a strength exceeding 980 N/ mm^2 and 590 N/mm^2, respectively.

Support for new claims 19-20 is found in the specification, e.g., at page 27, Table 1, Steel M; and page 41, Table 11, Steel M.

No new matter has been added by these amendments. Entry of the foregoing amendment and consideration of the following remarks are respectfully requested.

Rejection Under 35 U.S.C. § 112

Claim 18 is rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Claim 18 has been cancelled, rendering the rejection moot. Applicants respectfully request that this rejection be withdrawn.

Rejection Under 35 U.S.C. § 103

Claims 1 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutomu JP2001-342543 (JP'543) in view of Yasuhara et al. US 6,364,968 (US'968).

Claim 1 is directed to steel sheets having a structure of primarily bainite. The present inventors has discovered that hole-expandability is remarkably improved by the formation of Mg-sulfides, which conventionally has not been recognized. Equations (1) to (3) are designed to allow the precipitation of Mg-sulfides while impeding the precipitation of Mn-sulfides resulting in the combined precipitation of MgO, MgS and (Nb,Ti)N. Mg precipitates have the effect of improving ductility and end-face properties. See the specification at p. 16, ll. 22-36.

The Examiner acknowledges that JP'543 does not teach or suggest Al in the amount from 0.08% to 1.5% as recited by claim 1. However, it is the Examiner's opinion that US'968 teaches a steel *having a composition similar to that of JP'543* and Al in an amount of not more than 0.15%, which overlaps with the claimed range. The Examiner contends that a person of ordinary skill in the art would apply the US'968 teachings of the Al amount to the steel of JP'543. See, office action at page 4.

However, contrary to the Examiner's contention, US'968 teaches a steel having a very distinct composition as compared to that of JP'543. JP'543 teaches that Mg is one of the most important elements used in the invention. Mg forms oxides which suppress crack formation (JP'543 at ¶ [0023]). JP'543 further teaches that Al is a critical component for interacting with Mg to suppress crack formation. However, the amount of Al cannot be more than 0.07%. Otherwise, the effects of Mg will be impaired. Specifically, JP'543 discloses:

> Al is one of the most important additive elements in the present invention. Al easily forms $MgAl_2O_4$ composite oxides having a spinel structure when Mg is added. $MgAl_2O_4$ composite oxides are a form of the finest oxides among composite oxides of Al_2O_3, SiO_2, MnO, and including MgO and are believed to be effective for making the state of dispersion of the oxides more uniform and finer. For this reason, at the time of punching, fine voids are formed. These suppress the stress concentration and thereby are believed t o have the effect of suppressing the formation of coarse cracks and are believed to have the effect of improvement of the hole expansibility. Due to this, 0.002% or more is added. However, *if the amount of addition increases, the effect of addition of Mg is impaired, so the amount is made 0.07% or less*. In particular, to raise the ratio of the MgAl composite oxides among the composite oxides in the oxides and efficiently achieve greater fineness of oxides, the amount of addition is preferably 0.02% to 0.07%.

(JP'543 at ¶ [0024] from the translation provided with the response filed September 8, 2009, emphasis added). US'968 does not teach or suggest a steel composition having Mg. Nor does US'968 recognize the effects of Al on a Mg containing steel. A person skilled in the art would have recognized that increasing the amount of Al in the JP'543 Mg containing base steel in accordance with the US'968 teachings would have defeated the JP'543 invention and led to a steel unsuitable for the purpose of JP'543, e.g., suppressing the formation of coarse cracks. Thus, a person skilled in the art would not have combined JP'543 and US'968 in a manner as suggested by the Examiner.

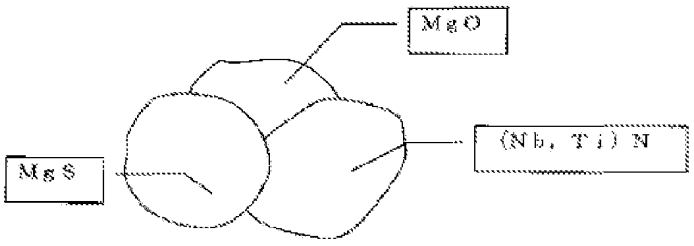
In addition, as discussed in the previous response, JP'543 teaches steel sheets having a structure of primarily ferrite. See, translation of JP'543, p. 36, first paragraph, and pp. 43-

45, ¶¶ [0006]-[0010]. JP'543 does not teach or suggest steel sheets having a structure of primarily bainite. JP'543 does not teach or suggest controlling the oxygen level to not more than 0.005 %, to controlling Mg depending on the amount of O (Eq. 1), or controlling the amounts of C, Mn, Ti, and Nb in accordance with equations (5)-(7).

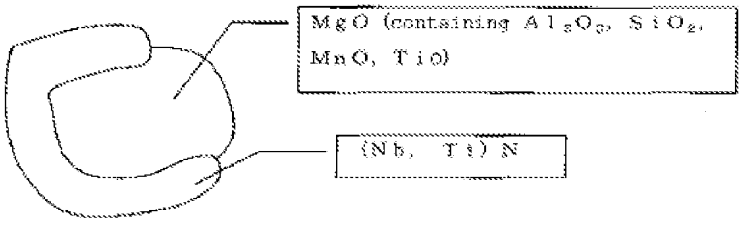
JP'543 does not teach or suggest the claimed composite precipitates of MgO, MgS and (Nb, Ti)N. Instead, JP'543 teaches MgO inclusions or combined precipitates, such as Al_2O_3, SiO_2, MnO and Ti_2O_3, or combined precipitates surrounded by (Nb, Ti)N, as shown in the following Fig. 1, which are quite different from those of the present invention. More precisely, JP'543 describes that MgO is preferable with one or more complex oxides such as Al_2O_3, SiO_2, MnO and Ti_2O_3. See, paragraph [0027]. Further, Mg and $MgAl_2O_4$ mainly have an effect of form of fine void by means of neighboring precipitation of (Nb, Ti)N neighboring those complex oxides, and it is considered MgO and $MgAl_2O_4$ contribute as nuclei for uniform distributed precipitation. See, paragraph [0028]. Fig. 1 shows a comparison of the present inventive combined precipitates and the inclusion described in JP'543.

Fig. 1

Present inventive combined precipiates



Inclusion disclosed in JP'543



Applicants further note that the objective of JP'543 is to secure a mainly ferrite microstructure and teaches a steel composition and processing steps in order to achieve the disclosed tensile strength, hole expansibility and ductility. For example, JP'543 explicitly

teaches an air cooling temperature of less than 700°C. JP'543 for the purpose of securing the mostly ferrite microstructure. See, JP'543, at p. 54, ¶ [0035]. Thus, a person of ordinary skill in the art would not seek to modify the JP'543 heat treatment process that provides the very microstructure that endows the steel sheets with the inventive property of excellent hole expandability.

Also, the Examiner contends that the presently claimed steel sheets can be achieved by routine optimization of the amounts of the added elements. Applicants respectfully submit that "[a] particular parameter must first be recognized as a result-effective variable, *i.e.*, a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." MPEP at p. 2100-152 (rev. 6, Sept. 2007). In the present case, each of the recited equations defines a relation of the amounts of two or more added elements, which must be satisfied to achieve the tensile strength, high hole expandability and ductility. For example, equation (1) $[Mg\%] \geq ([O\%]/16 \times 0.8) \times 24$ requires that the amount of Mg be no less than a quantity determined based on the amount of O. In order to find such an equation, a person skilled in the art would have to first discover a correlation between the amounts of Mg and O affects hole expandability and ductility, and then experiment to find the relation between the amounts of Mg and O and to obtain the equation. None of the cited references recognizes, e.g., that a correlation between the amounts of Mg and O affects hole expandability and ductility. None of the cited references teaches or suggests controlling the amount of O in its steels. Therefore, the relation as defined in equation (1) is not recognized as a result-effective variable. The same applies to each of the rest recited equations. A person skilled in the art would not have arrived at these equations by routine optimization.

US'968 does not remedy the deficiencies of JP'543 for at least the reasons discussed above. Thus, claim 1 is patentable over JP'543 and US'968, either individually, or in combination. The rejection to claim 1 should be withdrawn.

Claims 9-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsutomu JP2001-342543 (JP'543) in view of US 6,364,968 B1 to Yasuhara et al. (US'968)

Claims 9-11 are directed to steel sheets with having a ferrite + bainite structure which achieves superior strength, expandability and ductility by, *inter alia*, controlling the amounts

of added elements according to Equations (1)-(4). The present inventors discovered that hole-expandability is remarkably improved by the formation of Mg-sulfides, which conventionally has not been recognized. Equations (1) to (3) are designed to allow the precipitation of Mg-sulfides while impeding the precipitation of Mn-sulfides resulting in are combined precipitation, of MgO, MgS and (Nb,Ti)N. These Mg precipitates have the effect of improving ductility and end-face properties. See the specification at p. 16, ll. 22-36.

For similar reasons discussed above in connection with claim 1, JP'543 and US'968 would not render claims 9-11 obvious. For example, a person skilled in the art would not have combined JP'543 and US'968 by modifying the JP'543 base steel with the amount of Al as taught in US'968 because such a modification would have led to a steel unsuitable for the purpose of JP'543.

In addition, as discussed in the previous response, in order to secure the adequate amount of ferrite effective for the enhancement of ductility, C, Si, Mn and Al contents must satisfy equation (8): $-100 \leq -300[C\%]+105[Si\%]-95[Mn\%]+233[Al\%]$. If the value of equation (8) is smaller than -100, ductility deteriorates because an adequate amount of ferrite is not obtained and the percentage of the second phase increases. See, specification at the paragraph bridging pages 22 and 23.

JP'543 does not teach or suggest the additional constraints on the amounts of the added elements as defined by the recited equations. JP'543 does not teach or suggest controlling the oxygen level to not more than 0.005 %, controlling Mg depending on the amount of O (Eq. 1), or controlling the amounts of C, Si, Mn and Al in accordance with equations (8). JP'543 does not teach or suggest the claimed composite precipitates of MgO, MgS and (Nb, Ti)N. JP'543 does not teach or suggest Al in the amount from 0.08% to 1.5%.

US'968 does not remedy the deficiencies of JP'543 for at least the reasons discussed above. Thus, claims 9-11 are patentable over JP'543 and US'968, either individually, or in combination. The rejection to claims 9-11 should be withdrawn.

Double Patenting

Claim 1 is rejected on the ground of non-statutory obviousness type double patenting as being unpatentable over claims 1 and 2 of co-pending application no. 10/550,252, corresponding to U.S. Patent Publication No. 2006/023 1166 A1. To expedite the

prosecution of the present application, and not acquiesce to the correctness of Examiner's rejection, Applicants submit herewith a terminal disclaimer. The double patenting rejection is therefore obviated and should be withdrawn.

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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